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THE SHASTA, SIERRA, LASSEN, TAHOE, AND DONNER STRAWBERRIES

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THE SHASTA, SIERRA, LASSEN, TAHOE, AND DONNER STRAWBERRIES¹

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INTRODUCTION

THE FIVE NEW STRAWBERRY varieties described in this bulletin are being introduced for trial in central and northern California as fresh market berries. Their adaptation to southern California conditions has not been adequately determined. All have shown some merit in one or more districts of the central or northern part of the state, but most of the tests have been conducted in the central coast area. Since none has been sufficiently tested to determine the extent or limits of its adaptation, no final recommendations for use can be given here; nor is it assumed that all five varieties will have enduring value.

The berries are the first to be introduced as a result of breeding work carried on for several years by the University of California Agricultural Experiment Station and initiated at the request of the Central California Berry Growers Association of San Francisco in 1926. At that time the virus disease yellows, or xanthosis, was causing a rapid decline in strawberry production in California.⁴ The most logical means of combating the disease appeared to be the development of resistant varieties through breeding. Many years ago Albert Etter of Ettersburg, California, crossed the wild beach strawberry, *Fragaria chiloensis*, with various other sorts. Since some of these crosses showed considerable resistance to yellows, the present authors used them as basic material in their early breeding work. To offset partially the low dessert quality normally carried in the *F. chiloensis* and in the standard variety, Nich Ohmer, it was necessary to cross them with berries of high dessert quality. For this purpose some of the United States Department of Agriculture selections supplied by Dr. George M. Darrow were used.⁵ The Nich Ohmer was used for its fall-producing character and proved to be a valuable parent. The normal short life of this plant was offset somewhat by crossing with the longer-lived selections of *F. chiloensis* parentage. Through a system of recrossing selections and pyramiding desirable characters, there were gradually built up selections possessing a portion of the characters desired by the industry such as resistance to yellows, longevity of plant, good market and shipping quality, and continuous or high fall production.

The Marshall-type varieties, including Banner, Marshall, and Oregon Plum, have long been the standard in strawberry production in central and northern California; yet these varieties offer little help in a breeding program because

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⁴ Plakidas, A. G. Strawberry xanthosis (yellows), a new insect-borne disease. *Jour. Agr. Res.* 35:1057-90. 1927.

⁵ Darrow, George M., George F. Waldo, C. E. Schuster, and B. C. Pickett. Twelve years of strawberry breeding. II. From 170,000 seedlings, seven named varieties: A summary of the crosses made and an evaluation of their effectiveness as breeding material. *Jour. Hered.* 25:451-62. 1934.

of their extreme susceptibility to the virus diseases and their tendency to transmit this character when used in crossing. Eastern varieties in general have not been successful in California and were not valuable as parents except for some specific character. Most of the crossing in recent years has been therefore between selections made and tested under California conditions and exhibiting some of the characters mentioned above. Crossing work by the junior author was begun in 1930, and during the period from 1932 to 1938, when the varieties here described were bred and selected, a total of 55,000 seedlings were fruited.

At the outset of the breeding program the seedling testing was carried out at the University of California Deciduous Fruit Field Station located near San Jose. The Station is located in the heart of the central coast strawberry district, where environmental factors are average for the district; and it was believed that any selection made would likely prove adapted to the entire area. The yellows disease was prevalent; and if immunity to it could be obtained in a desirable selection, the problem would in a large measure have been solved. It soon became evident, however, that no clone was immune to the yellows disease; that while some were nearly symptomless carriers, there was slow degeneration, with the probability that the selection would sooner or later be discarded. Evidence indicated the improbability of obtaining in the center of any strawberry-growing district any variety that would long remain free of the virus diseases. Immunity to the diseases was apparently very rare if at all possible, and the logical procedure to follow in the breeding program appeared to be the development and holding of all seedlings in an isolated area free of strawberry culture of old varieties. The project was accordingly moved to an area in the Santa Cruz Mountains, approximately 8 miles away from other strawberry plantings, and continued for a two-year period. At the end of this time it was evident that the virus disease was filtering in and that the area was not free of the disease as had originally been assumed. In 1935 the project was moved again and this time was set up in the Sacramento Valley in an area isolated by 10 or more miles from any strawberry district. The seedlings were fruited there, and selections made. Foundation stock of each selection was then kept in that district, which was assumed to be an area relatively free of virus diseases. Later experience has indicated that this was a desirable practice.

Selections made in the Sacramento Valley cannot be assumed to have adaptation in coastal areas, and testing to determine adaptation there is necessary and is normally done. Fall production can be ascertained only in the coastal area, and resistance to the yellows disease is best determined there. Though high resistance to yellows is desirable, some selections possessing only moderate resistance have succeeded reasonably well. Experience indicates that if such selections are from foundation stock that is free of the virus and are not set out too early in the spring, they escape widespread infection the first growing season and produce good crops even though virus diseases may be present in the district. In this manner selections possessing only moderate resistance can be used successfully.

The new varieties represent what appear to be the most promising of the crosses made in 1935 and 1936. They are released to replace the yellows-

susceptible Marshall-type varieties and the unvigorous and short-lived Nich Ohmer variety.

The five introductions have been under limited acreage production in the central coast area. All have been selected by growers for expanded plantings and by them deemed worthy of continued trial for fresh-market purposes even though some of the characters are not ideal. In dessert quality, when taste, aroma, and flavor are considered, some of the new varieties are much inferior to Banner, long a standard berry in that respect. From the growers' viewpoint, however, there are compensating characters—fall production in the coastal area, high total production, desirable shipping and market qualities, disease and insect resistance. These offset the objectionable low dessert quality and justify release of the selections for further trial. In a market berry the maintenance of a bright and fresh appearance is imperative. The individual grower, planning for his particular area, must weigh one character against another or a group of others, to determine whether or not the variety is adaptable to varying local conditions and is acceptable to the trade.

The varieties described vary in their resistance to virus diseases. It is probable that none possesses sufficient resistance to make it profitable for long if continuously propagated in an area where virus diseases exist, such as the central coast district of California. The experience of growers thus far, however, indicates that if disease-free stock is propagated in an area free of virus diseases and is not planted adjacent to infested fields or set too early in the spring, all varieties here named will succeed in so far as these diseases affect the yield of fruit. If this procedure is not followed, there is some uncertainty whether those varieties that are moderately susceptible to these troubles will yield profitably for more than two years.

The five varieties have perfect flowers botanically. None, however, has been grown entirely alone and away from other strawberries, and thus all have had the opportunity for cross-pollination. All apparently produce enough pollen to ensure a good set of berries, though the quantity of pollen will vary with the season.

In the coastal area of California, strawberries sometimes vary considerably in fruit characters with the successive crops produced. The descriptions given below may therefore not remain accurate throughout a producing season; variation from the details given may occur at times.

SHASTA

Adaptation and Origin.—The Shasta variety has shown promise in nearly all test plantings made in the central coast area of California. It was used successfully by commercial growers in the San Jose and Salinas districts during the 1943 and 1944 producing seasons. In the interior valleys too few trials have been made to determine its adaptation to these districts. Along the coast it produces well in the summer and fall and has merited recognition because of this character.

Shasta has been tested under the California number of 403.8. It is the result of a cross made in 1935 and was selected in 1937. One of its parents was California 67.5—a cross between Nich Ohmer and an unnamed United States Department of Agriculture selection numbered 634. The other parent was

California 177.21, a cross made between Department of Agriculture selection 543 and California 68.24. The latter was in turn a cross between Department of Agriculture selection 634, mentioned above, and New York (Geneva) Agricultural Experiment Station selection 4626—a cross of Marshall and Howard 17. A short form is sometimes used to designate this parentage as follows: Cal. 403.8 = Cal. 67.5 (Nich Ohmer \times U.S.D.A. 634) \times Cal. 177.21 [U.S.D.A. 543 \times Cal. 68.24 (U.S.D.A. 634 \times N.Y. 4626)].

Characterization.—The Shasta plant, though not large, is reasonably vigorous. The leaves are dark bluish green; their characteristic wrinkled surface and downward cupping distinguish the variety from most others. The plants are shorter lived than those of other varieties herein described, but in longevity nevertheless surpass Nich Ohmer, which often produced well for only one

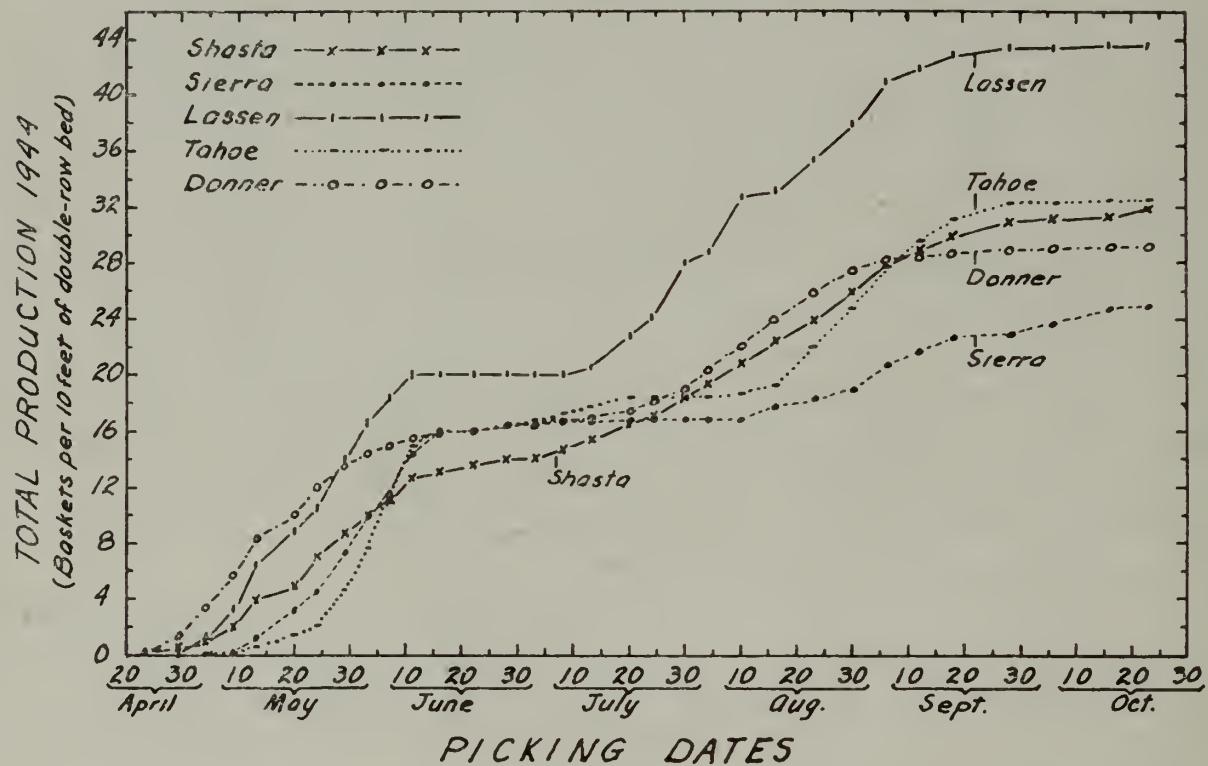


Fig. 1.—The production record for 1944 obtained in a test plot at the University of California Gill Tract near Berkeley. It represents the general type of production that may be expected of each variety in the central coast area of California, although seasonal variations occur from year to year. Note the continuous type of production of Shasta and compare with a variety like Tahoe having distinct peaks of production and a long summer of low yields. From the viewpoint of continuous use of labor in commercial plantings Shasta is the better type. At Salinas, Lassen usually has produced another peak in its crop, starting about the end of October and extending into November.

season and very rarely for more than two. Runner production, though only medium, is sufficient to fill the bed when plants are set at the rate of 7,000 to 8,000 per acre, as occurs in the 40-inch spacing in the staggered double-row raised-bed system employed along the central coast.

The berry is round conic or bluntly conic in shape and is usually uniform and symmetrical. The fruit colors evenly, as it ripens, to a medium red that holds well on the fresh-berry market. The skin is medium tough, and the flesh firm but moderately juicy. The fruit is of medium to large size and is produced on long flower stalks, during the summer and fall. It is not of high dessert quality and usually rates from fair to medium good. In this respect it does not equal Banner, but surpasses Nich Ohmer.

The bearing season for Shasta, in the central coast region of California, usually starts the last week in April. Production is fairly continuous through the summer and fall, as indicated in figure 1. Usually more of a peak occurs in August or early September and is sometimes followed by another (with less volume) in October.

Shasta has produced consistently well from year to year in the coastal districts and is probably the most widely adapted of any of the varieties here introduced. While primarily a fresh market berry, it may, judging from preliminary trials, have use in preserving.

Shasta is reasonably resistant to mildew and virus diseases and somewhat resistant to *Verticillium* wilt. Nubbins or button berries are often produced in the summer crop.

Technical Description of the Fruit of the Shasta Variety.—Size medium large; form round conic to blunt conic; color medium red and glossy; seeds greenish yellow, placed even or flush with the surface, medium sized, and medium to widely spaced; skin medium tough; texture firm, medium juicy; slight cavity at times; flesh medium red throughout; shipping quality good; dessert quality fair to medium good; flavor mild subacid; calyx large, at times leafy; good spring, summer, and fall production in the central coast area of California.

SIERRA

Adaptation and Origin.—For the foothill region the Sierra variety is perhaps the best adapted of any here introduced. In the coastal area it does reasonably well but is not so heavy and continuous a cropper as the others. The berry is late and at times produces most of the spring crop late enough to escape the rains that often spoil the early crop. This character has particular significance in the foothill regions. The variety is introduced for trial there and in the interior valleys of California.

Sierra (Cal. 537.5) resulted from a cross made in 1935 and was selected in 1937. It is a cross between Nich Ohmer and Cal. 177.21 [U.S.D.A. 543 × Cal. 68.24 (U.S.D.A. 634 × N.Y. 4626)].

Characterization.—The Sierra plant is fairly tall and vigorous. The leaf, moderately wrinkled, is at times cupped downward. In this respect it does not differ greatly from Shasta (fig. 2). The leaf color, however, is not so deep a blue green. Sierra is a very good plant maker and, in comparison with other varieties, has fair longevity.

The flower stem, long and high branching, bears the blossoms above the leaves in the summer and fall crop. The berry shape is conic, sometimes wedge conic, and is fairly regular. The usual color, a medium red with good gloss, gives a good appearance; and this holds well after picking. In some seasons, however, part of the fruit ripens with a white tip that has failed to develop properly. The skin and flesh are medium firm. The primary berries are large, but the size drops somewhat as the later berries on the inflorescence mature. The dessert quality is good.

Sierra is about 10 days later than Shasta, but normally bears as good a spring crop or better. Along the coast, for 2 months following the middle of June, production is rather low (fig. 1); but a late summer crop starts about the middle of August and continues into October. For the coastal area, where

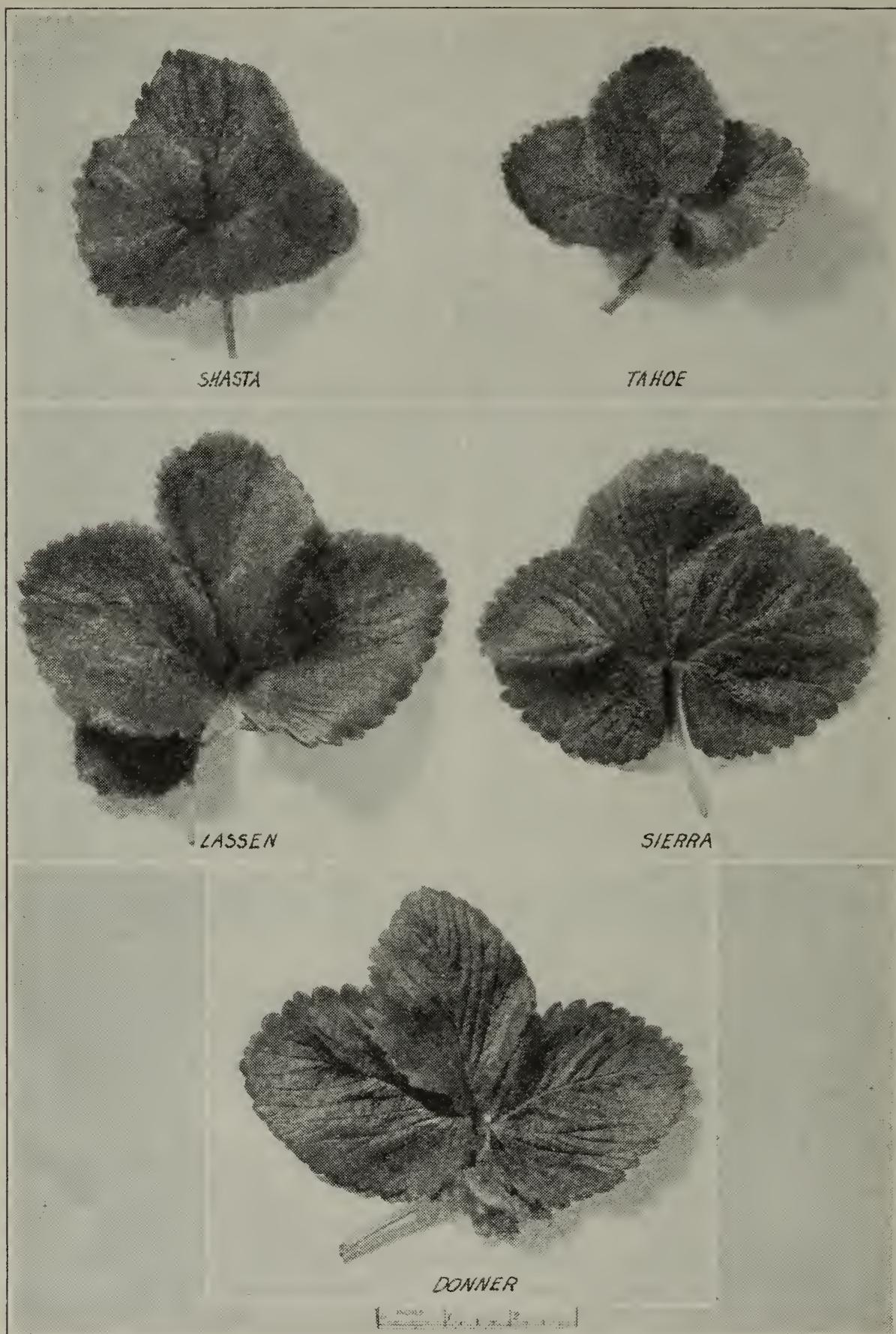


Fig. 2.—Illustrating the varying leaf characteristics of the five varieties as occurring late in the fall. Note the wrinkled appearance of the Shasta leaf and the tendency to cup downward. This is also partly true of Sierra, but the two may be distinguished by the deeper blue green color of Shasta. The Tahoe leaf is small in comparison with the others and has a tendency to cup upward. The Donner leaf is flat and comparatively smooth. Lassen tends to roll somewhat at the leaf edge, but is not cupped or wrinkled.

continuous production is sought, the low production during the early summer makes the variety less desirable than some of the others.

Sierra is moderately resistant to the yellows disease and has shown no particular weakness.

Technical Description of the Fruit of the Sierra Variety.—Size medium large; shape conic or wedge; color medium red, with good gloss; seeds yellow or reddish when exposed; position of seeds varying from flush with the surface to raised; size medium large, and spacing medium; skin medium; flesh medium firm, of good red color; small hollow; slight aroma and good dessert quality; calyx medium large, reflexed, and easy to separate; white tips, at times, on mature berries; good shipping quality; good total production, but with a period of low production in summer along the coast.

LASSEN

Adaptation and Origin.—The Lassen variety has been used successfully in commercial trials along the central coast during the seasons of 1942, 1943, and 1944. Since it has not been used in the interior valleys, its adaptation there is not known. It is recommended for trial as a market berry in the coastal area, where high production, fair shipping quality, and longevity of plant are desired. Since the dessert quality is moderately low, the variety may have little value as a home-garden sort.

Lassen (Cal. 544.2) originated from a cross of Cal. 21.9 [Blakemore \times Cal. Z9 (Banner \times Fendalcino)] and Cal. 161.1 (Nich Ohmer \times Cal. 86.6). The latter is a cross between U.S.D.A. 634 and Cal. Z11 (Banner \times Fendalcino) made in 1936. Selected in 1938, Cal. 544.2 was chosen for outstanding production by a grower in 1939.

Characterization.—The Lassen plant is vigorous and larger than either Shasta or Sierra. The crown is medium dense. The leaves are large, smooth, and glossy, of a medium deep-green color. The plant makes runners freely.

The Lassen flower stems are medium long and high branching. The berry is large and fairly regular, but varies in shape from blunt conic or rounded to short wedge. It is light red but has a good gloss and good market appearance, which it holds rather well despite a fairly tender skin and soft, juicy flesh. The flesh color is only slightly red. The variety has little or no aroma and only fair or low dessert quality; in the latter respect it is not much better than the low-quality Nich Ohmer, used for many years in the central coast area.

Production in this variety has been consistently high in the coastal area and is generally characterized by three peaks during the fruiting season. The spring crop starts midway between that of Shasta and Sierra. As a rule, there is a period of very low production, extending roughly from June 15 to July 15 (fig. 1). This is followed by another period of good production. There is usually a late crop, maturing in October and November; but this may not be completely harvested if prolonged rainy weather occurs in early fall.

Lassen is very susceptible to *Verticillium* wilt and moderately susceptible to mildew. It appears highly resistant to the yellows disease and is a very long-lived plant. In some seasons nubbin berries are common in this variety during the summer.

The only important use of Lassen is as a fresh market berry. For this purpose it has valuable and desirable characters such as large size, good market appearance, high production, virus-disease resistance, and longevity of plant. These characters may not be sufficient, however, to offset low quality and to make it a popular market sort.

Technical Description of the Fruit of the Lassen Variety.—Size large, holding well through the crop; shape normally blunt conic or rounded, but varying at times to short wedge, moderately regular; light glossy red; many nubbins during some seasons; seeds yellow, flush with surface, medium in size and spacing; skin tender; flesh soft, juicy, and slightly red; slight hollow; no aroma; dessert quality low to fair, but shipping quality good; calyx medium sized, separating easily; production high, with three seasonal peaks to crop.

TAHOE

Adaptation and Origin.—The Tahoe variety is late and somewhat seasonal, but has shown consistently high production in the coastal area, and especially in the Salinas district. In the interior valleys it has not been tried sufficiently to determine its usefulness there. Since it appears to be valuable chiefly as a general market berry in the coastal area, it is being introduced for trial for this purpose.

Tahoe (Cal. 567.6) is the result of a cross between Cal. 144.21 (Narcissa \times Nich Ohmer) and Cal. 143.32 [Narcissa \times Cal. BH-14 (mixed crosses)] made in 1936 and first selected in 1938.

Characterization.—The foliage of Tahoe is tall and vigorous, and the crown moderately dense. The leaf is of medium size, has a smooth surface, and is mildly cupped. The plant has exhibited good longevity and is an excellent producer of runners.

The berries are produced on strong, upright, high-branching stems. This characteristic is valuable in keeping them off the soil, especially in the spring crop. They are long conic and consistently symmetrical or regular in form, medium red in color. Although not glossy they make a fairly good appearance on the market. The flesh is medium firm, fairly juicy, light red, and but slightly aromatic. Though the berries are only medium large, the size holds well during the cropping period. The dessert quality is medium good.

Tahoe is late and starts production along with Sierra, which in many ways it parallels. Production is low for a period of 2 months, roughly from June 15 to August 15 (fig. 1); it rises again in August and continues through September and into October.

The variety is fairly resistant to *Verticillium* wilt and to yellows and is more resistant to red spider than are some of the others. A degenerate type of "breaking" resulting in phyllody has occurred in Tahoe, but the number of such plants has been extremely small thus far. The percentage of nubbin berries is often fairly high during the summer.

Technical Description of the Fruit of the Tahoe Variety.—Size medium large; shape long conic, with good symmetry; color medium red, with a medium gloss; seeds yellow or reddish when exposed, flush with the surface of the berry, and medium in size and spacing; skin moderately tender; flesh moderately firm and juicy, slightly red; slight hollow; very little aroma;

dessert quality medium good; shipping quality good; total production good, with peaks in May and August-September on the coast, light production in early summer.

DONNER

Adaptation and Origin.—The Donner variety, an early-season sort, starts production along with Shasta or before. In trial plots it has been somewhat variable in production, but usually bears a good spring crop. Its fall production is normally light in the coastal area of California. Since the dessert quality is very good, the variety may be desirable as a home-garden berry as well as a fresh market type. Being highly susceptible to *Verticillium* wilt, it should not be used where tomatoes have been grown previously.

Donner (Cal. 579.4) is a selection made in 1938 from a cross made in 1936 between Cal. 145.52 [Cal. BH-14 (mixed crosses) \times Redheart] and Cal. 222 [Cal. 66.2 (U.S.D.A. 634 \times Banner) \times Cal. 7.20 (Blakemore \times Nich Ohmer)].

Characterization.—The Donner plant is large and vigorous—normally the largest of any of the five varieties here described. The leaves are oval and flat, with long petioles. The plant has exhibited medium-good longevity. Runner production is good.

The flower stem is never long, and the fruit is usually covered by leaves; it is not, however, difficult to pick. The berry has a long conic shape and is somewhat irregular. The color is a bright attractive red, with a gloss that holds well on the market and gives it good appearance. It ripens evenly. The Donner has a medium skin and a medium firm flesh, but keeps well. The size is medium large to large. The dessert quality is very good—nearly equal to that of Banner, which would be rated excellent.

The variety is early and bears a good spring crop, but does not continue production so late in the fall as do Lassen and Shasta. In commercial trials in the coastal area, total production has been satisfactory, but not equal to that of Lassen. The variety has not been tested in the interior valleys sufficiently to determine its value there.

The high dessert quality, fine appearance, and ability to hold on the market make the Donner a very satisfactory market berry.

The variety is not resistant to the yellows disease and is highly susceptible to *Verticillium* wilt and to the cyclamen mite. It is resistant to mildew, however, and normally is relatively free of nubbins or deformed fruits.

Technical Description of the Fruit of the Donner Variety.—Size medium large, holding fairly well through crop; shape long conic and moderately irregular; color medium red, glossy, attractive; seeds yellow and flush with the surface, small and medium spaced; flesh juicy, medium firm, and red throughout when ripe; slight to medium hollow; dessert and shipping quality good to very good; flavor subacid; calyx medium sized and varying from clasping to reflexed; light fall production.

NAMING OF THE VARIETIES

The names of the varieties introduced were borrowed from mountains and lakes of California. Sierra is named for the Sierra Nevada range; Shasta for the highest peak in the northern part of the State; Lassen for another peak in that region—the only volcano in the continental United States showing

activity in recent years. Tahoe is taken from the largest lake in California; Donner from another celebrated lake.

Plants of the varieties named are not for sale or distribution by the University of California, but may be purchased from nurserymen.

SUMMARY

Five new strawberry varieties resulting from the breeding work carried on for several years by the University of California Agricultural Experiment Station are introduced for trial in northern and central California as fresh market berries. All produce in the fall in the central coast region.

Selections with *Fragaria chiloensis* parentage, having resistance to the virus disease yellows, crossed with good-dessert-quality varieties or selections, were used as basic parents for the crosses from which the five varieties named were selected. Nich Ohmer was the principal parent from which fall production was obtained.

The adaptation, origin, and characterization for each of the five varieties and the technical description of the fruit are given.

The names used were taken from mountains and lakes of California.